LUBRICATION

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We invite correspondence from all those interested.

Those who fail to receive LUBRICATION promptly, will please notify us at once and will confer a favor by promptly reporting change of address.

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ECONOMY IN LUBRICATION

It is a curious fact that while economy in the power factor required to run any machinery has been very closely studied for a great many years, and a number of mechanical devices have been brought out with a view of reducing the amount of friction in the moving parts of such machinery, the feature of the economy of lubrication which deals with the different friction losses on account of the use of different oils, has only been partially studied. One very excellent reason for this lack of study (in regard to the practical advantages of different oil products for different friction conditions) has been the impossibility, up to within the last few years, of securing a sufficient range of oil products of different classes to make comparisons of value. The systems of lubrication at present used and the determination of friction loss, etc., were largely based upon the use of one particular class of crude and consequently one particular character of lubricating oil so that apart from the variations in viscosity, etc., necessary for use in different classes of machinery, no other comparisons were possible.

Specifications convenient for the refiner's use in manufacturing, and equally convenient for comparing oils from the same crude, were drawn up and used from the experiments and study so conducted, and where oil is bought on specification these conditions largely obtain at the present time.

In the meantime, however, the oil business has undergone considerable change, new fields have been discovered and newer methods of refining brought into use. In some cases the oil from new fields has shown characteristics varying widely from those oils which were used at the time the specifications were written. Study of such oils and the newer methods of refining used for the purpose of fitting these oils for the market, have demonstrated that products can be made which are satisfactory for practically all purposes of lubrication, and which in some cases possess unusual advantages for lubricating conditions, but which at the same time, on account of the different characteristics of the oil, do not meet

the specifications originally made and still adhered to.

The fact of the matter is that the industry has long outgrown the specification, and at the present time in many cases, friction loss can be reduced to a greater degree with a smaller percentage of waste where these old specifications are not adhered to. The situation is analogous to the condition which has arisen in many industries. The use of steel and concrete in building construction necessitated an entirely new set of specifications for the sizes of columns, girders, beams, etc., in connection with certain floor loads. New methods and discoveries in the manufacture of a great many commodities have entirely changed the necessary specifications in the course of the last ten or twenty years. As a matter of fact, purchasing oil on the basis of specifications does not mean that the oil received will represent the most economical product for the conditions involved in any way; it means simply that the competition will be restricted without any determination of value as to what will be received.

The wide range of oils which can be at present secured upon the market for lubricating purposes, giving entirely different indications on the usual tests, and the fact that these oils have been successful in economically lubricating, illustrates the ineffectiveness of the specification.

As a matter of fact, economy in lubrication is dependent not only upon the oil but upon the mechanical devices which are used as a part of the lubricating system, the character of the bearings, the local conditions in regard to the plant itself, and other matters, all of which are apart from the quality of the oil furnished. The lubricant is only one factor in the economical reduction of friction and waste power, and no indication which is of thorough value as to the suitability of a certain lubricant for the purpose can be secured until practical tests have been made under the actual conditions of each day's service. It is in practical tests that the value of lubricants can be most thoroughly determined. In a number of plants the cost of lubrication is not known, the cost of the oil bought is readily determined from the price paid and the amount consumed; evidently this only represents a portion of the cost of lubrication, which cost may be increased many times the total amount of the oil bill by stoppages, repairs, waste of time, unnecessary power cost, etc. Practical tests carefully developed will show not only the value of the lubricant tested, but will also determine any weaknesses there may be in the other parts of the lubricating system. The most reliable manufacturers of lubricating oil are usually in a position to furnish practical lubricating engineers who are thoroughly acquainted with all the systems and devices for lubrication, as well as the question of lubricants. Practical tests made by such men, working in conjunction with the engineers at the factories, will in general determine in a very short time the value of the lubricants suggested from an economical standpoint.

From the viewpoint of the reputable manufacturer of lubricants, the opportunity to conduct practical tests is a very much more satisfactory method of successfully meeting lubricating problems than any attempt to sell lubricants on a specification. It enables the expert lubricating engineer to determine very thoroughly from an examination of the plant, the lubricant required to perform most economically the service of reducing friction under the conditions developed, both in regard to the character of the machinery involved and the conditions of the lubricating system. This means that by the practical testing of lubricants under the requirements of the plant, an improvement in the service can

usually be brought about from the combination of the manufacturer's lubricants, engineer's experience and the factory engineer's knowledge of all his particular requirements. We have pursued this method of overcoming lubricating problems and troubles wherever it has been possible to do so, and the general success which this method has attained, not only in insuring the use of lubricants exactly suited to the purpose, but in general improvements to the system of lubrication, where desirable, has shown us that the practical testing of lubricants on the ground is the only method which will entirely determine the value of the service which such lubricants can render.

LUBRICATION OF ELECTRIC RAILWAY MOTOR AXLE BEARINGS

Hot axle bearings on electric railway motors are very often wrongly charged to lubrication, especially on high speed electric roads equipped with the latest types of electric railway motors designed for lubrication by wool waste saturated with oil.

One of our representatives was recently requested to consult with the representative of a large electric railway property, relative to an epidemic of hot motor axle bearings they were having, and the trouble had become so serious that the motor manufacturer and the contractor, who was furnishing the oil, and who had agreed to furnish expert mechanical service on just such matters, had been repeatedly called on to assist in curing the trouble. They both had made many excuses and suggestions, but neither had offered any solution which had in any way reduced the trouble, and it continued to increase daily.

The Texas Company was not furnishing the lubricants to this road but their representative was requested to assist in correcting their hot axle trouble, which he did cheerfully, and without cost to the railway company. Our representative made an exhaustive examination of all the equipment and all the conditions. All the brasses from the bearings that had run hot were collected and each motor on which these bearings had been used was carefully examined, and it was found that nearly all the trouble had developed with the bearings on the pinion end of the motor. Our representative found that the bearing housings of the motor case had worn to an irregular shape, and that in a very few days after the brasses had been relined and the car placed in service, the bearings soon ran hot again, and upon removing them, it was found that on the outside of these brasses, there were many small blisters, showing that there was an electric sparking or arcing taking place. An examination was made of all the ground wiring in all the cars and it was discovered that in nearly all of them the entire return current was grounding through the bearings on the pinion end of the motor. That as soon as the lining of the brasses became slightly worn, the brasses shifted their position to the worn shape of the housings, making a loose connection which undoubtedly caused the arcing, and in a short time heated the bearings to such a high temperature as to run the metal.

The ground wires were immediately readjusted, the grounds changed so that there was an equal distribution of the grounds and the trouble immediately ceased, and no further trouble has been experienced along this line.

The motor axle bearings must not be confused with the journal bearings. Hot journal boxes have often been charged to electric heating, but this is wrong, as the journals and its brass bearings are outside the car wheel and

the return current in grounding to the rail does not pass through the journal but always follows the line of least resistance and the most direct one to the rail, passing through the axle bearings (which support the motor case on the axle) into the axle to the hub of the wheel directly to the rail, and will not at any time heat the journal or its brass bearings.

CIRCULATING FEED SYSTEMS

Circulating feed systems met with in practice come under four separate and distinct classes which may vary slightly according to the opinion of the engineer in charge, or the operating conditions. They are known as the:

(A) Individual Gravity Feed Systems;
(B) Individual Continuous Force Feed Circulating Systems;
(C) Splash Feed Circulating Systems;
(D) Continuous Circulating Gravity Feed System.

The adaptability of any one of the above systems depends entirely upon the size of the plant and type of installation. The method usually met with in practice in each case is as follows:

(A) Individual Gravity Feed System:

The lubricant is fed to the bearings and eccentrics by gravity, pressure obtained by having a reservoir of from two to four gallons capacity elevated sufficiently (usually two or three feet above the highest point of feed) to overcome the resistance of the oil feed pipes.

The oil after leaving the bearings and eccentrics is reclaimed by flowing into pans, if of old design, and from engine base, if of new design, into buckets, or a receiver separator, and then emptied into an independent filter. The supply in the reservoir is replenished with filtered oil taken from the filter. In some cases a filter reservoir is used, and the oil instead of flowing into the buckets flows into a receiver separator. In this case the system could be classed as (B).

(B) Individual Continuous Force Feed Circulating System:

The individual continuous force feed circulating system of modern installation consists of a continuous piping system directly connected to a combination settling tank and filter, same being installed in close proximity to the unit and in the engine room proper.

Oil is forced from the filtered oil compartment to all bearings by a small piston or plunger pump which is usually connected to some reciprocating motion on the engine.

The reclaimed oil flows by gravity into the settling compartment, and in accordance with the design of the filter, is allowed to precipitate any entrained water and foreign matter, filtered either by the dry or washing method, overflows the filtering compartment, and from thence is again pumped to the various bearings.

(A) and (B) are the same when (A) is directly connected to a filter.

(C) Splash Feed Circulating Feed Systems:

Splash feed circulating feed systems are met with in both horizontal and vertical and closed crank case engines. With this system, crosshead, wrist pin, guides and crank pins are lubricated by the ordinary splash system. The lubrication of the pillow block bearings and eccentrics is accomplished by collecting the oil which adheres to the crank disk and is taken off at the highest point on the periphery, this supply flowing by gravity to the bearings and returning by gravity to the crank case.

Filtration in this case is only accomplished by removing the supply in the crank case and running same through an independent filter. One rarely sees or hears of the using of filtered oil for replenishing the supply in this system. The usual practice is to drain the entire system once or twice monthly in accordance with the operating conditions, using unused or new oil in this system and the filtered oil for general lubrication of the plant. In the earlier designs of this system of lubrication no attempt was made to take care of the condensation at the piston packing, and this was allowed to enter and mix with the oil supply in the crank case. With the agitation of the mixed oil and condensed steam, there is a tendency for the oil to emulsify. This tendency becomes much greater if the oil has been improperly treated in refining.

With the steam escaping into and being condensed in the crank case, a small amount of cylinder oil is injected into the crank case oil. This cylinder oil has necessarily to some extent emulsified and the mixture is naturally further deteriorated.

These difficulties are largely overcome in the later designs, by means of a distance plate or double stuffing box, thereby preventing any condensation from entering the crank case and mixing with the supply of oil.

Arrangements are also made in the later designs of horizontal crank case engines, by which the water entering the crank case is removed by an overflow. This overflow pipe is connected to the lowest point of the case, and the outlet elevated to the proper oil level, which is to be maintained within the crank case. Any increase in the elevation of oil in the case, caused by additional water, naturally causes an overflow of same; water being the heaviest, precipitates and is forced out through the overflow pipe. This principle is the same as used in automatically dispelling water from oil filters.

This system gives very good results when using a suitable grade of engine oil, and greatly improves when connected to a combination separator and filter, in which case the system then would come under the class of (B).

(D) Circulating Gravity Feed Systems:

Circulating gravity feed systems are arranged by having all units piped and connected from one gravity tank in most cases and occasionally from two. This gravity tank usually being located in the engine room proper and elevated sufficiently to produce a head or pressure per square inch which will overcome the resistance of the pipes and fittings and insure positive feed at all times. Engines are properly panned so that the waste oil flowing from the bearings is reclaimed. In each case pans or engine bases are connected and piped to one main return drain, this, in the majority of cases, being carried under the engine room floor. All drains from the pans or engine bases pass through the floor and are then connected to the main return pipe. This main return pipe is installed so that the oil will flow by gravity into either a combination settling tank and filter or into a settling tank only, as the case may be. This being governed by the size and space. Oil is then allowed to precipitate all foreign matter and entrained water, after which it is filtered either by the dry or washing method.

The filtered oil is elevated into the gravity tank from the filtered oil compartment either by an automatic electrically connected float contained in the gravity tank, rotary hand pump, steam piston pump or plunger pump, and again flows from the gravity tank through the same system. It is customary, if the system is large and space warranted, to have a separate settling tank and filter, usually located in the basement of the plant.

The object of this is two-fold; first, it will allow ample space so that the drain pipes can be properly pitched, allowing the waste oil to drain by gravity into the settling tank and filter, and obviate the necessity of pumping the oil from the settling tank into a filter usually located in the engine room proper.

Second, it is also possible by having the drain pipes underneath the engine floor to bring the oil to a higher temperature, as exhaust pipes and auxiliary steam lines are usually carried under the engine room floor.

By increasing the temperature of the waste oil and also that contained in the settling tanks and filters, the return flow to the settling tank and the filtration are improved on account of the increased fluidity of the oil, accelerating the separation of the oil and allowing impurities, as well as the entrained water, to precipitate in a shorter period of time.

Cases are met with where it is necessary to have the filtering tank and settling tank installed in the engine room, but in these cases it is due to the limited space in the basement.

As a general rule, the capacities of circulating feed systems, that is, of the settling tanks and filters installed are inadequate, and in some cases the method of filtration is not properly arranged for the best results.

The capacity rating of settling tanks and filters can only be governed by considering the number of feeds to be supplied and the total quantity of oil to be fed per hour or per twenty-four hours, and not by the rated horsepower of the unit or units.

It is good practice to allow the oil in the settling tank to have at least twelve hours' time to properly settle and filter, and no system should be installed whereby the entire supply of oil passes over the system more frequently than twice in twenty-four hours.

Capacities of systems as well as that of settling tanks and filters should at all times be governed entirely by the rate of flow, by which is meant the quantity of oil to be filtered per hour or twenty-four hours. For instance, a system to be installed on a 500 H.P. cross compound engine, having say ten feeds and rate of flow as determined by measurement to be twenty gallons per hour or 480 gallons per twenty-four hours. A system of this kind should have at least a filtering capacity of 60 sq. ft. or 300 gallons per twenty-four hours. This would then allow the oil to pass over the entire system twice every twenty-four hours. In a great many cases, however, such a system will be installed with a capacity much less than the amount required.

In all cases the filter should have ample capacity, whereby it is possible to have a needle stream of oil flowing to the bearings instead of drops per minute. With a stream of this kind it is possible to reduce the co-efficient of friction to a minimum and also touch directly upon the fuel cost.

The question of proper capacity, as well as designs of settling tanks and filters, is a very vital point to be considered, and more so when high viscosity oils are used for lubrication. This question can be treated as follows:

1.—Rated capacity *vs.* actual capacity

2.—Advantages as well as disadvantages of the washing and dry method of filtration, as well as the necessity of heating oil to the proper temperature during filtration.

The successful operating of any settling tank and filter depends upon the actual filtering capacity and directly and only upon:

1.—The mesh and area of the effective straining surface.

2.—Upon the area of the effective heating surface.

3.—Upon the area of effective precipitating surface.

From the above it can be seen that in installing the filter in connection with any style of the foregoing circulating systems, it is very essential that the *actual* filtering capacity be taken into consideration only and not the *rated* capacity.

The latest types of filters are equipped with a steam jacket, steam usually taken from the exhaust line. In some cases heat is obtained electrically by having a resistance coil wound around the tank of proper ohmic resistance, so that it can be connected to any A.C. or D.C. circuit.

When cylinder oil is used for piston and tail rod lubrication, the only possible and feasible way to prevent mixing is by installing a drip pan directly under the piston or tail gland, so that the cylinder oil wiped off by the packing will drip off the gland into the drain pan instead of dripping and mixing with the oil from the guide. By installing a pan in this manner it not only prevents considerable cylinder oil from getting into the system, but also prevents condensation, which usually has the same effect on the oil.

There is absolutely no rule whereby it would be possible to give the rate of flow necessary or the size of the settling tanks or filter, but this is governed entirely by the design of the engine, the duty, and is somewhat governed by climatical changes. Also, the characteristics of the unit or units would govern this to some extent. Some manufacturers of filter and circulating systems have compiled data as to the hourly filtering capacities necessary, same being based upon the rate of horse power of the units. This could not be used as a standard as designs of engine, for any rated horse power may vary very greatly. The unit may be either a tandem compound, cross compound, twin or simple engine; in such case the number of feeds would not be the same, irrespective of the rated horse power, so that the rate of flow should at all times be determined by measurement.

The safest means of installing a circulating feed system of any description is to—

1.—Ascertain the rate of flow of oil necessary which will not only bring the bearing temperatures down to a minimum, but also reduce the co-efficient of friction and thereby touch directly upon the power cost.

2.—Adopt a filter having the largest value as to quantity and quality; filters should have at least 3 sq. ft. of filtering surface for each gallon of oil per hour to be filtered.

3.—Should possess the following features: Continuous operation —15 to 20 hours' oil supply at all times.

Accessibility for cleaning.

Should have minimum floor space.

Oil level to be maintained automatically in gravity tank.

Inspecting and cleaning should be accomplished without shutting down the system.

Should be equipped with sediment trays and fine mesh strainers so that the heavy impurities are removed before final filtering, which allows finer filtering material to be used.

Tank should be entirely free from pressure.

Water should be automatically expelled.

Gravity tank should be elevated sufficiently to assure positive feed at all times, and its capacity should be from 15 to 20 hours' operation.

All piping of proper dimensions and connected as directly as possible.

Drain or return pipes installed so that rodding can be done easily should same become

stopped, thereby eliminating dismantling of same.

If floor space will permit settling tanks and filters should be placed beneath the engine room floor so that waste oil will return to the settling tank and filters by gravity.

It is necessary to have filters installed in connection with circulating systems with maximum head pressure on the filtering surface as well as maximum filtering surface for each gallon of oil to be filtered per hour.

In conclusion would say that the requirements necessary for any type of efficient circulating feed systems are:

A continuous stream of cool oil, same to be applied at the proper point;

An efficient collecting system whereby the waste oil from the bearings will show the highest quantity value;

The filter which will thoroughly remove all impurities, metal and entrained water from the oil and have large cooling value. The operation must be automatic and absolutely reliable.

Piping to be direct as possible

A COMPARATIVE TEST

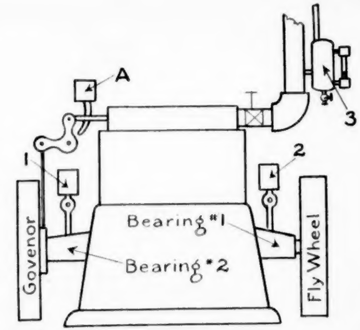
On the two pages following, we publish the charted results of an investigation made in the plant under ordinary working conditions to compare the efficiency of Texaco Lubricating Oil, and the oil previously used on a Westinghouse Automatic. It is through careful tests and investigations like this, in the plants of all descriptions that we are demonstrating the advisability of installing Texaco Lubricants, and have acquired a large amount of extremely valuable information on lubrication which we can and do use in the service of prospective customers. The two charts published herewith show quite conclusively a saving in oil cost alone on one unit, but indicate through the reduction in friction the large saving which is actually accomplished by the effective reduction of the heat producing quality, that is, excessive friction.

The results of the investigations in every line of manufacturing and power industry has given us sufficient basis to prescribe the oil that will be most suitable to *your* purpose and which will operate most efficiently to increase your production and decrease your power cost.

Give us the opportunity to investigate your lubricating conditions, for we believe that with our experience and the high quality of the oils themselves, we will be able to provide a saving and increase your service to a considerable extent.

COMPARATIVE TEST

Eng. Westinghouse Crank Case
Size 13, 22 x 13. Steam Pressure 100 lbs.
Rated H.P. 125.0



COMPARATIVE TEMP. AND FEED PER MIN. READINGS

	Competitor's oil				Tex. crank case oil				Reduction
	Aver. Aug. 20	Aver. Aug. 21	2 day Aver.	Fric. Aver.	Aver. Aug. 22	Aver. Aug. 23	2 day Aver.	Fric. Aver.	
Room Temp. °F . . .	96.16	97.83	96.99		95.8	89.83	92.81		
Gov. End Bearing No. 1 °F	183	185	184	87.01	179.3	179.3	179.3	86.49	.52= .5%
FlyWh." " " 2 °F	188	187.6	187.8	90.81	180.6	174	177.3	84.49	6.32=6.9%
Crank Case °F	200	197.5	198.75		199	198.8	198.9		
No. 1 Lub. (Gov'end) D.P.M.	69	69	69		55.3	49	52.1		16.9=24.5%
" 2 "(FlyWh.)end "	64	66	65		59	48	53.5		11.5=17.7%
" 3 " (Hydro) "	6	5.3	5.65		6	6	6		
" 4 "(RockerArm)" } " 5 " (Eccentric) }	Determined by actual consumption								
Load									
Engine hours	24	24	24		24	24	24		

OIL CONSUMPTION PER TWO (2) DAYS' RUN OF 24 HRS. EACH

Dates	Hrs. run	Pts. cyl. oil	Pts. crank case oil	Pts. Eng. Oil
Aug. 20	24	5.375 pts.	23 pts.	2.75 pts.
Aug. 21	24	5.375 "	23 "	2.75 "
Totals	48	10.75 pts.	46 pts.	5.5 pts.
Aug. 22	24	0	18.5 pts. Tex. C.C.	0
Aug. 23	24	0	18.5 " " " "	0
Totals	48	0	37 " " " "	0

COMPARATIVE COST PER 2 24-HR. DAY RUNS, AUG. 21 AND 22, 1912

Former oils 10.75 pts. cyl. @ .05 pt. cost 0.5375 Total cost on former oils $1.4202	46 pts. C.C. @ .13 cost .7452	5.5 pts. Eng. @ .20 cost .1375

COMPARATIVE COST PER 2 24-HR. DAY RUNS, AUG. 22 AND 23, 1912

Texaco crank case oil 37 pts. @ .0187 cost $0.6919 Reduction in cost during run on Tex. C.C. oil of $0.7283 or 51% for 48 hrs. " " pts. " " " " " " "25.25 pts." 40.5% " " "	Per annum $131.54 " " pts. 4608.125

CHECK ON D.P.M.—HYDROSTATIC LUBRICATOR

Former oils	Texaco oil
D. P. M. 6 Length of run per 1" of oil—50 min. 1" of oil by meas.=114 C.C.=.241 pt.	D. P. M. 6 Length of run per 1" of oil—50 min. 1" of oil by meas.=114 C.C.=.241 pt.

COMPARATIVE READINGS — FEEDS AND TEMP. °F. WESTINGHOUSE AUTOMATIC

COMPETITOR'S OIL

Date	August 20, 1912				August 21, 1912				
Time	10.00 A. M.	10.30 A. M.	11.00 A. M.	Average	10.00 A. M.	10.30 A. M.	11.00 A. M.	Average	Two-Day Average
Room Temp. °F.	94.5	97	97	96.16	98.5	98	97	97.83	96.99
No. 1 Bear. Gov. End °F.	183	183	183	183	185	185	185	185	184
No. 2 Bear. Flywheel °F.	188	188	188	188	188	188	187	187.6	187.8
Crank Case °F.	200	200	200	200	198	197	197.5	197.5	198.75
No. 1 Lub. (Gov. End) D. P. M.	69	69	69	69	69	69	69	69	69
No. 2 Lub. (Flywh. End) D. P. M.	64	64	64	64	66	66	66	66	65
No. 3 Lub. (Hydro.) D. P. M.	6	6	6	6	6	5	5	5.3	5.65
No. 4 Lub. (Rocker) D. P. M.	Determined by								
No. 5 Lub. (Eccentric) D. P. M.	Actual Consumption								
R. P. M.	230	230	230	230	230	230	230	230	230

TEXACO CRANK CASE OIL

Date	August 22, 1912				August 23, 1912					
Time	10.00 A. M.	10.30 A. M.	11.00 A. M.	Average	10.00 A. M.	10.30 A. M.	11.00 A. M.	Average	Two-Day Average	Results
Room Temp. °F.	96	95	96	95.8	90	89.5	90	89.83	92.81	
No. 1 Bearing °F.	180	180	178	179.3	179	180	179	179.3	179.3	Reduction .52 or .5%
No. 2 Bearing °F.	180	180	182	180.6	173	174	175	174	177.3	Reduction 6.32 or 6.9%
Crank Case °F.	198.5	199.5	199	199	198.5	199	199	198.8	198.9	
No. 1 Lub.	57	57	52	55.3	51	48	48	49	52.1	Reduction 16.9 or 24.5%
No. 2 Lub.	59	59	59	59	48	48	48	48	53.5	Reduction 11.5 or 17.7%
No. 3 Lub. Hydro.	6	6	6	6	6	6	6	6	6	
No. 4 Lub.	Determined by									
No. 5 Lub.	Actual Consumption									
R. P. M.	230	230	230	230	230	230	230	230	230	

Oil in use August 20th and 21st, Competitor's Oil. Oil in use August 22nd and 23rd, Texaco Crank Case A.

ONE OIL WE ARE ESPECIALLY PROUD OF

That oil is Texaco Motor Oil.

We have hosts of enthusiastic users. It has surprised many a motorist by showing him the amount of power his car is capable of developing when oiled with Texaco. The manner in which Texaco Motor Oil reduces wear on the moving parts, and provides freedom from carbon trouble, has amply earned its designation as "the care-free oil."

WHY WE GET RE-ORDERS

The Brownsdorf Mueller Company,
Manufacturers of Improved Mechanic's Tools,
Elizabeth, N. J.

February 9th, 1912.

THE TEXAS COMPANY,
New York City.

GENTLEMEN:—We have used your cutting oil for about two months and wish to state that we find it superior to the one we used before. The oil is used over and over again a number of times. We find its cutting quality lasting, and we shall keep on using it and you may expect our future orders.

Yours very truly,
BROWNSDORF MUELLER CO.,
(Signed) Chas. P. Mueller,
Vice-President.

TEXACO IN PANAMA

Down at the Big Ditch, Texaco is on the job promoting efficiency, saving fuel, power and wear.

In this great engineering feat, Texaco Lubricants are used exclusively.

This is an important contract and it has been secured on a quality basis.

From the Cyclopean steam shovels to the smallest donkey engine, from the whirring dynamo to the journals of the smallest dump cart, every piece of machinery is running better, smoother, longer and more economically through the aid of Texaco Lubricants. Many unusual and severe lubricating conditions are encountered here and the creditable showing that Texaco is making is but another positive proof of the truth of our claims for the whole line of Texaco Lubricants.

"THE ITALICS ARE OURS"

The William Cramp & Sons Ship and Engine Building Co.
Office of the Chief Engineer,
Philadelphia, U.S.A.

August 6th, 1912.

THE TEXAS COMPANY,
Philadelphia, Pa.

GENTLEMEN:—Texaco Ursa Oil was used for turbine lubrication on the recent trials of the destroyer *Beale* and battleship *Wyoming*, proving very satisfactory. Both vessels successfully completed their official contract trials at sea without having had any preliminary trials of machinery beyond dock trials at low power. Consequently, *the journals had very little previous wearing in to take off the high spots, and the fact that we had no bearing trouble of any importance* during the sea trials, reflects great credit upon the lubricant used. Yours very truly,

F. J. METTEN,
Chief Engineer.

No comment is needed on this letter. It tells more about Texaco Quality than volumes.

Give us an extremely difficult or unusual lubricating problem to meet—we have encountered them before and Texaco Quality has invariably come out ahead.

Let one of our representatives call on you and give him an opportunity to demonstrate the lubricants that pay their way.

ON TEXACO QUALITY

Given an excellent crude to begin with, extensive practical experience in lubricating practice, and an Ideal in refining, and you get the reason for Texaco Quality.

The Reason, however, is not as important to you as Results—we can show many convincing examples.

There is hardly a field of mechanical endeavor in which we have not been able to demonstrate the advantages of Texaco Lubricants. Our representatives have gone into plants of all descriptions, from monster steel mills to the plant using only a single unit to all classes of power users or power producers, and have demonstrated to every class of user how Texaco Lubricants operate to effect economies.

OIL AND THE COAL PILE

There is a very close connection existing between the quality of lubricating oil employed and the consumption of the coal pile. It can be plainly seen that when frictional resistance has to be overcome, in order to carry the same load, a larger head of steam is required, and therefore, more fuel; but when the friction losses are reduced and this energy transferred to power units, through proper lubrication, the coal pile must last longer. We have shown numbers of power users a direct saving on fuel through installing Texaco Lubricants, and they have adopted our oils for their regular use without even investigating the other economies which Texaco effects, and these economies are considerable ones also.

"Texaco Lubricants cost less because they save more."